

## Textured Nonwoven Fabric

### Technical Field

5 The present invention relates to a method of creating a textured nonwoven fabric for apparel and home fashions applications, and more specifically, a nonwoven fabric comprising a permanent distressed texture upon laundering of the nonwoven fabric.

### Background of the Invention

10 It has become desirable and considered stylish in the clothing and home fashions industries to impart an aesthetically pleasing pattern, texture, and/or color to a fabric. Traditionally, woven fabrics have been handled in this manner to provide the clothing and home fashions industries with such enhanced aesthetic-quality fabrics, however the production of conventional textile fabrics is known to be a complex, multi-step process. The production of fabrics from staple fibers begins with the carding process where the fibers are opened and  
15 aligned into a feedstock known as sliver. Several strands of sliver are then drawn multiple times on drawing frames to further align the fibers, blend, improve uniformity as well as reduce the diameter of the sliver. The drawn sliver is then fed into a roving frame to produce roving by further reducing its diameter as well as imparting a slight false twist. The roving is then fed into the  
20 spinning frame where it is spun into yarn. The yarns are next placed onto a winder where they are transferred into larger packages. The yarn is then ready to be used to create a fabric.

For a woven fabric, the yarns are designated for specific use as warp or fill yarns. The fill yarn or fiber packages (which run in the cross direction and  
25 are known as picks) are taken straight to the loom for weaving. The warp yarns (which run on in the machine direction and are known as ends) must be further processed. The packages of warp yarns are used to build a warp beam. Here the packages are placed onto a warper, which feeds multiple yarn ends onto the beam in a parallel array. The warp beam yarns are then run through a slasher  
30 where a water-soluble sizing is applied to the yarns to stiffen them and improve abrasion resistance during the remainder of the weaving process. The yarns are

wound onto a loom beam as they exit the slasher, which is then mounted onto the back of the loom. Here the warp and fill yarns are interwoven in a complex process to produce yardage of cloth.

In contrast, the production of nonwoven fabrics from staple fibers is known to be more efficient than traditional textile processes as the fabrics are produced directly from the carding process. Nonwoven fabrics are suitable for use in a wide variety of applications where the efficiency with which the fabrics can be manufactured provides a significant economic advantage for these fabrics versus traditional textiles.

A review of prior art indicates wrinkles have been introduced into woven fabrics for aesthetic as well as functional reasons. U.S. Patent No. 6,025,284 discloses a sun protective fabric that is a permanently wrinkled polyester fabric with UV absorbers. Incorporating wrinkles into the fabric functionally serves as an additional barrier to provide protection from UV light. The wrinkles are permanently fixed into the fabric by stuffing a jet-dyeing machine with an excessive amount of fabric and then heat setting the resultant wrinkles into the fabric.

U.S. Patent No. 5,679,438 discloses a method of decorating woven fabrics by imparting wrinkles into the fabric and then heat setting the wrinkles. In one embodiment, the wrinkles are imparted by a wrinkler, in which the conventional printing apparatus is modified by the addition of a wrinkler.

Fulfilling a need for a more efficient mode of producing fashionable, innovative fabrics, it is in accordance with the present invention to provide an aesthetically appealing and durable hydroentangled nonwoven fabric suitable for the apparel and home fashions industries, which resembles that of a woven fabric. The said nonwoven fabric takes on a permanent wrinkled appearance once laundered.

#### **Summary on the Invention**

The present invention relates to a method of creating a textured nonwoven fabric for apparel and home fashions applications, wherein the nonwoven fabric becomes aesthetically altered upon laundering. Once

laundered during manufacture, the nonwoven fabric exhibits a permanent distressed appearance that becomes an integral part of the fabric. Subsequent to laundering, the fabric can be formed into a roll for shipment and storage. The distressed appearance of the nonwoven fabric is best described by comparing the  
5 laundered fabric to an elephant's skin.

The disclosed nonwoven fabric is characterized as unique since it is first textured with an image on an image-transfer device, then the imaged fabric is given a second distressed texture without being subsequently chemically treated, compoundly imaged on an image-transfer device, or embossed by a roll. The  
10 resultant hydroentangled nonwoven fabric of the present invention has a distress-free appearance until laundered, after which a controlled amount of wrinkling is imparted.

#### **Brief Description of the Drawings**

FIGURE 1 is a diagrammatic view of the apparatus for forming the  
15 nonwoven fabric.

FIGURE 2 shows the fabric before and after laundering.

#### **Detailed Description of the Invention**

While the present invention is susceptible of embodiment in various forms, hereinafter is described a presently preferred embodiment of the  
20 invention, with the understanding that the present disclosure is to be considered as an exemplification of the invention, and is not intended to limit the invention to the specific embodiment illustrated.

With particular reference to FIGURE 1, therein is illustrated an apparatus for practicing the method of the present invention for forming a nonwoven  
25 fabric. The fabric is formed from a fibrous matrix, which comprises fibers selected to promote economical manufacture. The fibrous matrix is preferably carded and subsequently cross-lapped to form a precursor web, designated P.

FIGURE 1 illustrates a hydroentangling apparatus for forming nonwoven fabrics in accordance with the present invention. The apparatus includes a  
30 foraminous-forming surface in the form of a flat bed entangler 12 upon which the precursor web P is positioned for pre-entangling. Precursor web P is then

sequentially passed under entangling manifolds 14, whereby the precursor web is subjected to high-pressure water jets 16. This process is well known to those skilled in the art and is generally taught by U.S. Patent No. 3,485,706, to Evans, hereby incorporated by reference.

5           The entangling apparatus of FIGURE 1 further includes an imaging and patterning drum 18 comprising a three-dimensional image transfer device for effecting imaging and patterning of the now-entangled precursor web. After pre-entangling, the precursor web is trained over a guide roller 20 and directed to the image transfer device 18, where a three-dimensional image is imparted  
10       into the fabric on the foraminous-forming surface of the device. The web of fibers is juxtaposed to the image transfer device 18, and high pressure water from manifolds 22 is directed against the outwardly facing surface from jet spaced radially outwardly of the image transfer device 18. The image transfer device 18, and manifolds 22, may be formed and operated in accordance with  
15       the teachings of commonly assigned U.S. Patents No. 4,098,764, No. 5,244,711, No. 5,822,823, and No. 5,827,597, the disclosures of which are hereby incorporated by reference. It is presently preferred that the precursor web P be given a three-dimensional image suitable to provide fluid management, as will be further described, to promote use of the present nonwoven fabric in apparel and home fashions. The entangled fabric can be vacuum dewatered at 24, and  
20       dries at an elevated temperature on drying cans 26.

          Hydroentanglement results in portions of the precursor web being displaced from on top of the three-dimensional surface elements of the imaging surface to form an imaged and patterned nonwoven fabric. Following the  
25       imaging station in Figure 1, the imaged nonwoven layer is dyed by any commonly known practice such as a jet dying or stock dying. In an alternate process of the invention, the imaged nonwoven fabric is wound into a roll and transferred to a separate practicable printing means.

          Depending on the amount of hydroentangling performed on the  
30       nonwoven fabric, the laundered end product will have more or less of a distressed texture. It is believed that the nonwoven fabric has a small degree of

fiber movement occurring and the movement of the fiber in a wet environment (under relaxed conditions) allows the fibers to move relative to the planar construction of the nonwoven fabric causing the fabric to "pucker" and appear distressed. The more the nonwoven fabric is hydroentangled, the more restricted in movement the fibers are and therefore, the fabric appears less distressed.

Coloration of the fabric will affect the amount of texture since colors can obfuscate or accentuate the wrinkles due to light refraction. The amount of texture in the fabric is also affected by the fiber type or fiber blend that makes up the fabric. Dissimilar fibers react or behave differently to hydroentanglement and therefore the laundered end product will have more or less texture depending on the fiber type.

It is known to one skilled in the art that polyester fibers entangle better than lyocell, cotton, or rayon fibers, therefore the resultant laundered end-products comprised of 100% polyester have less of a distressed texture compared to a fabric comprised of 100% lyocell fabric. It can also be concluded that fabrics comprised of polyester blends would be more entangled and have less fiber movement when laundered than a fabric comprised of 100% cotton. Due to the limited fiber movement, the fabrics comprised of polyester blends would have less texture after laundered.

It is believed that the laundered nonwoven of the present invention becomes textured due to differential shrinkage of the different fiber types during the wetting process, home laundering, or commercial laundering of a garment or roll good. It is also believed that a nonwoven fabric of a single fiber composition, such as cotton, or fibrous blends, become textured due to several zones of micro-delaminations that does not have an deleterious effect on the overall integrity of the fabric. It is believed that slippage between fibers creates the permanently distressed appearance of the present fabric when it is subjected to laundering during fabric manufacture. Such slippage can be increased when there is a lack of compatibility of the fibers, such as by use of fibers having



differing surface characteristics for fabric formation. This can include fibers having differing compositions, or fibers having differing surface finishes.

5 The nonwoven fabric utilized in the present invention may be a composite or laminate comprised of fibers selected from either synthetic or natural fibers or a combination thereof. Synthetic fibers may be selected from a group of thermoplastic polymers such as polyesters, polyamides, polyolefins, such as polyethylene or polypropylene, their derivatives and combinations thereof. The fibers may also be cellulosic in nature such as cotton, wood pulp, or rayon. The nonwoven fabric may also be a blend of said synthetic and natural  
10 fibers. The fibers may be splittable fibers or fibers of differing geometric configurations. Preferred fibrous blends of the present invention include the combinations of cotton, rayon, polyester, and lyocell fibers; Lyocell fibers are man-made fibers made of wood pulp and available commercially under the name Tencel® as a registered to Courtaulds PLC Corporation of London,  
15 England.

The combination of fibers mentioned above can result in both heavier and lighter fabrics. The resultant heavier fabrics have a preferred basis weight range from about 3.0-8.0 ounces per square yard and a more preferred weight range from 5.0-6.0 ounces per square yard. The resultant lighter fabrics have a  
20 basis weight range from about 1.0-3.0 ounces per square yard and a more preferred basis weight range from 1.5-2.5 ounces per square yard.

It is also in the purview of the present invention that the nonwoven fabric comprises a chemical or mechanical finish or a combination of the two finishes. Such finishes can be a jet dye finish or one that affects the fabric's drape or  
25 hand. Softening agents may also be used to impart a better hand and provide a nonwoven fabric with better conformability.

Due to specific attributes of fibers such as strength, drapeability, and hand, specific fibrous blends are preferred depending on whether the fabric of the present invention is to be utilized in the apparel or home fashions industry.  
30 The preferred fibrous blend for the home fashions industry includes polyester

and lyocell fiber blends or polyester and rayon fibrous blends. For the apparel industry, a fibrous blend of cotton and polyester is preferred.

#### Test Procedures

##### Strip Tensile Test (D 5035)

- 5                This test is meant to measure the breaking strength of the fabric in units of either grams or pounds as well as measure the elongation of the fabric.

##### Crockfastness (AATCC TM8-1988)

- 10              This test may be preformed with a wet or dry sample. The sample is rubbed against a testing surface for a designated number of passes. Test results are rated on a scale of 1-5, where a rating of 5 indicates the lack of color transfer.

- 15              The test results, as provided in Table 1, reflect a sample that is a hydroentangled fibrous blend of 60% cotton and 40% polyester. Test results indicate that the sample remains unchanged after three home launderings. The sample has comparable strength and elongation in both the machine and cross direction. The data table indicates the multiple home launderings of the fabric do not have any negative affects on the fabric.

- 20              In one embodiment of the present invention, the disclosed nonwoven fabric is suitable for the apparel industry. The imaged nonwoven fabric is utilized in a bottom weight article for men or women, such as pants or shorts, wherein the bottom weight article takes on a distressed appearance once laundered.

- 25              In another embodiment, the nonwoven fabric of the present invention is suitable for the home fashions industry. The imaged nonwoven fabric is utilized in window coverings, bed applications, such as duvet covers, bedspreads, or comforters, and furniture coverings, such couch, love seat, or arm chair covers, wherein the previously mentioned home fashions would also take on a distressed appearance after laundering.

Table 1

	Test	Units	Sample 1 Jet Dyed	Sample 1
				Jet Dyed after 3 home launders
5	Basis Weight	(oz/yd2)	5.6	5.9
	Thickness	(mils)	29	32
	Tensile - MD	(lb/in)	85.2	88.3
	Tensile - CD	(lb/in)	99.1	98.0
	Elongation - MD	(%)	41.5	43.9
	Elongation - CD	(%)	65.6	70.9
10	Crockfastness- Wet	ranked 1-5	5	5
	Crockfastness- Dry	ranked 1-5	5	5

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